“Mathematical Study of Inventory Management for Perishable Items for Small Scale Organizations in NCR”

Synopsis submitted to IIMT UNIVERSITY in partial fulfillment of the requirements for the award of the Degree of

DOCTOR OF PHILOSOPHY

IN

MATHEMATICS

BY

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(Year-2024)

1.Introduction

Inventory Management:

Industrialization is one of the important aspects in modern era. The rapid speed of industry in today's Inida, provided many questions to different managers of industry. Out of these, one of important question is how to manage the inventory of an industry from purchasing the raw material to sell the finished items. The efficiency of management for the available items in an industry needs more attention as in every business house smooth running of all functions is the most important feature. In a small-scale business house, the input cost is biggest challenge to control as it has a role of almost sixty percent of all type of costs. At the same time, small scale business house cannot afford to increase the rates of their furnished items to meet the challenge of increment of input cost as per competitive market and business competition. So ultimately without any choice, a manger of business house is required to arrange his or her available items with more accuracy. In this case the available capital become more important in the reference of business development and it is truer for small scale business houses to develop and maintain their business in the country like India. The total capital arranged by a small-scale business house cannot be invest in only a single aspect to do the business. The amount which is invested in a particular aspect is termed as the running capital and the items purchased through it, are termed as inventory which is now needed more care than money in hand of a business house. As one can do much better management of inventory items that manager is doing better financial management also. Everyone must be accepted the truth that if you require the money then before going to bankers one must recheck his/her pockets, and pocket means here good inventory management. The well managed use of money always help to improve the service management also and help to increase the profit also by this process. All the above targets may be fulfilled by the maximization of output or profit of a business organization. So, it is required that every manager of any business house must be try to maximize the profit and minimize the cost by effective management of inventory and capital both. But on the other hand, it will be tough to increase the profit in between the competition of small-scale industries which are just on a door step distance. Hence the money resources and more production usually become useless without any effectiveness. In this situation many available methods are being tested and tried by different managers for the solution of all these problems. Out of these, the inventory control and management evolved one of the better ways to handle all these problems. By this a small-scale industry manager or maximum times, it is an owner can

increase the production rate and reduce the cost without blocking his money and taking loan from different banks.

The inventory management/control is one of the important analytical methods of management and controlling the money of a small-scale industry. It contains maximization/minimization of available resources to contain the stock of different materials from raw materials to finished goods.

If there is a lacking of stocks it may lead to stop of running of industry production, but on the other hand a large amount of inventory may cause a result of increment in production cost. Hence, optimize level of inventory/stocks must keep which are neither high nor low. The level of inventory items such as furnished items, semi completed items, equipment, raw materials, spare parts, human resources, and money in hand as well effects more than 75% or more of the working amount in small scale business houses as past records tell us. By above studies it is obvious that any efforts made towards better inventory management/control can increase the profit and in terms of saving for a company. A scientific method of controlling the inventory may lead to reduce investment of capital remarkably, it has been observed that sometimes it is up to 50 % or more.

Now a days with in the limited resources of small-scale business houses, managers have to do a comprehensive change in their way of holding the inventories as given constraints:

(i) Continuous increments in the capital size to establish any small-scale business house.
(ii) A lot of varieties and different type of variables of modern time requirements in small scale industry.
(iii) Clients and customers are unpassionate and having urgency all times.

The management of materials is also a very important aspect in the establishment of small-scale industry and the efficient way of implementation can give a significant support in the improvement of earnings. As far as the industry is working on small scale, the manager/owner will have to keep him/her updated in all phases from purchasing, production and selling the products. A manager/owner must make better decision and choice to choose from different options which are available for him/her at a time. When a small-scale industry or business house expands, the required number of perfectionists increases for controlling the different type of activities. These specialists technical or managerial officers are to be make choices by which money can be saved. At the same point, some choices which are saving the cost in

terms of one variable, can produce negative effect on the cost in another variable, and hence, no one is aware about the factors involves in the increment of the total cost. This type of mistakes may be removed only by effective management and stream line set-up. Hence, the management of raw materials, semi furnished products and finished products are the most important feature of a logistic supply chain system. Inventory can be treated as important as the blood in human body as we can compare that with out circulation of blood a human cannot survive, like wise without smooth functioning of inventory, no business house can run properly.

Inventory Modeling: Any problem of inventory management/control may be getting solution by different methods as started with hit and trial methods to methods achieved from mathematical modeling and methods of simulation modeling. Mathematical modeling can help us in getting some fixed/certain formulas which will provide us the suggestions that, how can we minimize the total cost of inventory where as we shall be deal only with deterministic demand or how can we minimize the expected cost where we shall be deal with probabilistic demand. In this present study we shall be deal only with deterministic type of demand in inventory control models and, we shall try to get the derivations of economic order quantity (EOQ) for a given inventory problem.

Steps of Building an Inventory Model: In this section we shall be discuss some important step which are crucial to made up an inventory model which is suitable to get the solution and after it to get the decision factors are given as below:

(i) Collection of the data to get the pattern/graph of the demand type, the policy of replenishment to replenish the inventory items, planning time of horizon, different type of inventory costs relevant with problem.

(ii) To develop the real-life situation into the inventory situation with correct logic, addressing correct assumptions and properties concerned with the situation.

(iii) To develop per cycle relevant cost equationin theform of given below:Per cycle relevant cost = Product Value + Cost of Procurement+ Cost of holding the product during the cycle + Cost of Shortage (It is not necessary that all the cost will play role at a same time, but as per situation out of this cost will applicable)

(iv) Transform the per cycle relevant cost equation in the terms of mathematical model which will be in the form of differential equations.

(v) To get the ooptimize solution of the per cycle relevant cost equation, by which we shall be try to get the optimum solution for the situation that "how much to order",& "when to re-order" and "the total relevant cost".

2. Literature Review: A brief review of the research done in this field in last few years, is being presented in here. Jaggi et al (2013) studied "credit financing in economic ordering polices for defective item with allowable shortages". Yadav and Vats (2014) provided "a deteriorating inventory model for Quadratic demand and constant holding cost with partial backlogging and inflation". Sharmila and Uthaya Kumar (2015) developed "inventory model for deteriorating items with quadratic demand, partial backlogging, and partial trade credit". Tripathi and Tomar (2018) studied "establishment of EOQ model with quadratic time sensitive demand and parabolic time linked holding cost with salvage value". Tripathi (2019) provided "innovation of economic order quantity (EOQ) model for deteriorating items with time-link edquadratic demand under non-decreasing shortages". Singh et al (2019) gave "inventory model for deteriorating items with incremental holding cost under partial backlogging". Kumar (2019) gave "inventory optimization model for quadratic increasing holding costand linearly increasing deterministic demand". Khan et al (2019)studied "inventory system with expiration date: Pricing and replenishment decisions". Ghandhari and Dezhtaherian (2019) gave "an EOQ model for deteriorating items with partial backlogging and financial considerations". Shaikh et al (2019) developed "economic order quantity model for deteriorating item with preservation technology intime dependent demand with partial backlogging and trade credit". Murthy and Karthigeyan (2020) developed "Fuzzy inventory model with quadratic demand, linear time dependent holding cost, constant deterioration rate and shortages". Hasan and Masud (2020) gave "an EOQ deteriorating inventory model with different types of demand and fully backlogged shortages". Rahman et al (2020) did "analysis of inventory model with time dependent quadratic demand function including time variable deterioration rate without shortage". Jani et al (2021) studied "How does an industry control a decision support system for a long time?" Srivastava and Bajaj (2021) gave "optimal inventory management system for deteriorating items with linear demand, shortages and partial backlogging in a triangular fuzzy setup". Shaikh et al (2021) gave "decision support system for customers during availability of trade credit financing with different pricing situations". Babangida and Baraya (2022) provided "an EOQ model for Non-instantaneous Deteriorating items with two phase demand rates, linear holding cost and partial backlogging rate under trade credit policy". Khare

and Sharma (2022) studied of “effects on inventory model in time deteriorate-rate with variable cost”. Khan et al (2022) provided “inventory management with hybrid cash-advance payment for time dependent demand,time varying holding cost and non-instantaneous deterioration under backordering and non-terminating situations”. Rajput et al (2022) studied “optimization of an EOQ model for deteriorating items with reliability influence demand”. Senbagam and Kokilamani (2022) provided “a partial back-ordering inventory model for log-gamma deteriorating items with quadratic demand and shortages”. Senbagam and Kokilamani (2023) provided “a partial back-ordering inventory model for Gompertz deteriorating items with quadratic demand and shortages in a fuzzy environment”. Sivashankari and Vijaya Kumar (2023) studied “effect of stock-dependent demand in EOQmodels for deteriorative items under linear, quadratic and exponential holding cost”. Yadav et al (2023) gave “multi-item EOQ model for deteriorating items having multivariate dependent demand with variable holding cost and trade credit”.

3. Objective of Proposed Research Work:

In this proposed research work, my specific research is to develop various models for inventory management, the objectives of research are as follow.

- To develop inventory model having two warehouses for deteriorating products where the demand depends on present stock level with trade credits for both warehouses.
- To develop the model for production house with time dependent decaying items with linear rate of demand.
- To focus on developing the inventory model under inflation for decaying products where demand is depending linearly on time.
- To develop an EOQ model for time dependent decaying products where demand depends on stock and pricee rates.

We shall be discussing a production model, for the reduceing the selling price in two warehouse environments with fixed demand up to certain time, after that, the demand rate dependent on its

reduction rate. We shall be work on inventory models in which the demand rate is constant or time dependent.

I will carry out work in view of highly competition of market, where the management of cost of warehouses is difficult task. So, it is necessary and essential to develop EOQ model as per to given storage space.

The expansion and appliance of inventory models for deteriorating items is one of the key concerns of the specialists in the field, as the number and variety of deteriorating products are radically growing. Numerous kinds of products such as pharmaceuticals, healthiness and cosmetics, crop, biological, petrochemical and substance materials are classified as deteriorating products.

4. Research Methodology:

The researcher will follow the following research methodology during the research period. It will be initiated by Literature survey and data collection followed by model development with authentication of models developed and numerical results. After developing the model, we shall go for publication of the technical papers followed by compilation of the results, theories developed and write of the thesis.

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